

创伤性 B 型主动脉夹层的诊疗进展

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摘要:本文聚焦于创伤性 B 型主动脉夹层(tramatic type B aortic dissection, TTBAD)的临床研究进展,总结其发病机制、临床特点与诊断、严重程度划分、治疗方法与预后随访。TTBAD 常见于创伤多发伤患者,早期准确诊断至关重要,损伤严重程度是决定 TTBAD 患者治疗策略与预后的关键,治疗上强调多学科协作,药物治疗和胸主动脉腔内修复术成为主要的治疗选择。但在不同严重程度 TTBAD 患者的治疗策略与手术时机选择上仍存在一定争议。

关键词:主动脉夹层;创伤;胸主动脉腔内修复术;手术时机

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Advances in diagnosis and treatment of traumatic type B aortic dissection

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Abstract: This article focuses on the clinical research advancements in traumatic type B aortic dissection (TTBAD), and summarized its pathogenesis, clinical features and diagnosis, severity classification, treatment modalities, and follow-up prognosis. TTBAD is commonly observed in patients with multiple trauma injuries, and making early and accurate diagnosis is imperative. The severity of the injury is a critical determinant in deciding the treatment strategy and prognosis for TTBAD patients. Treatment emphasizes a multidisciplinary approach, with pharmacotherapy and thoracic endovascular aortic repair (TEVAR) being the primary options. However, there remains some controversy regarding treatment strategies and the timing of surgery in patients with varying severities of TTBAD.

Key words: Aortic dissection; Trauma; Thoracic endovascular aortic repair; Timing of surgery

主动脉夹层(aortic dissection, AD)是由于各种因素使主动脉内膜撕裂,导致血液流入动脉壁内,形成主动脉壁的分层和分离,血管腔被游离内膜分为真腔和假腔。据估计,每年每百万人中有 5~30 人患主动脉夹层,其中男性的患病率较高,多见于 50~70 岁^[1]。导致 AD 的病因有很多,创伤是其中的一种特殊病因,创伤性 B 型主动脉夹层(tramatic type B aortic dissection, TTBAD)或钝性创伤性胸

主动脉损伤(blunt traumatic thoracic aortic injury, BTTAI),主要由交通事故或从高处坠落时胸部或背部受到创伤和压力引起^[2]。TTBAD 虽在 AD 患者中占比不高,但 TTBAD 是交通事故创伤患者中的第二大死亡原因,仅次于脑损伤^[3]。TTBAD 患者常常合并多发伤,病情复杂,死亡率高,在入院前 TTBAD 患者死亡率可高达 75%^[4],到达医院的患者院内死亡率高达 46%^[5-7],及时准确的诊断与治

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疗是挽救患者生命的关键。本文检索TTBAD相关文献,对TTBAD的临床研究进展进行综述,总结其发病机制、临床特点与诊断、严重程度划分、治疗方法、手术时机与预后随访。

1 发病机制

急性减速伤是创伤性主动脉损伤的最常见机制,最常见的损伤部位是主动脉峡部^[8],其他可能受累的部位包括升主动脉近端(8%~27%)、主动脉弓(8%~18%)和胸主动脉降支远端(11%~21%)^[1]。目前认为TTBAD的发生的机制主要包括^[9-13]:①主动脉峡部是从未固定的主动脉弓到固定的降主动脉的过渡区,在快速减速过程中,该区域容易在减速伤中向反方向运动,导致内膜撕裂;②胸骨结构和脊椎之间的压迫力在减速创伤时会挤压主动脉,血管内压力增加,导致主动脉急性挫伤;③主动脉峡部的抗张强度相对较低。笔者认为,主动脉峡部易受损亦与胚胎发育时动脉导管闭锁后的解剖位置有关,动脉韧带导致主动脉弓部与降主动脉之间连接为锐角并限制降主动脉的移动,急性损伤时突发的血流动力学与剪切力变化易导致主动脉夹层的发生,但这尚缺乏确切的实验证据。在实际损伤过程中,应是上述多种机制和力的共同作用。

2 TTBAD的临床特点与诊断

TTBAD属于急症,24h病死率高。由于常常合并其他器官损伤,病情复杂,容易漏诊。TTBAD患者一般有明确外伤史,常伴有脑损伤、胸部外伤,肋骨、胸骨、肩胛骨等部位骨折,而TTBAD诱发的剧烈疼痛常被这些创伤部位引发的疼痛所掩盖^[14-15],这是漏诊的主要原因。同时,笔者临床上发现,创伤患者常由于休克、昏迷、镇静或插管等因素,主诉往往没有特异性或者是缺失的,也为TTBAD的诊断带来挑战。TTBAD患者的其他临床表现、体征与非创伤性主动脉夹层患者并无太大差异,包括高血压、胸腔积液、双上肢血压可能存在的不对称等。但需警惕TTBAD患者出现低血压的概率较非创伤性主动脉夹层患者高,且往往预后不良。

影像学检查是确诊TTBAD的关键。胸部X线片是外伤患者常用检查,但其在诊断TTBAD中的特异性和敏感性都不高,TTBAD在胸部X线片中可能表现为纵隔增宽、主动脉结异常、胸腔积液^[16]。增强CT或CTA是目前诊断TTBAD患者的首选影

像学检查方法,具有便捷、特异度及敏感度高、空间分辨率高等优点^[17-18]。MRI在明确血管损伤上亦具有优势,但由于扫描时间较长,对于TTBAD患者应用困难,尤其是病情不稳定患者^[19];超声作为床旁检查,可发现主动脉弓部病变,虽然诊断准确率较CT低,但是对于病情不稳定患者具有优势。经食管超声适用于术中诊断主动脉病变,但主要适用于检查主动脉瓣、主动脉根部及升主动脉,由于气体干扰,在诊断主动脉弓及降主动脉病变的能力不足^[20]。血管造影及血管腔内超声因为有创操作,且血管造影在发现内膜损伤、壁间血肿或血栓化的假腔中的敏感性不高,已不作为TTBAD的首选诊断手段^[21-22],但是血管内超声是对于CT诊断不明确或存在造影剂禁忌证患者的有效补充,亦能为术中决策提供有效帮助^[23],国内的主动脉腔内超声应用程度较低。有研究分析了TTBAD患者和非TTBAD患者的三维CT形态学特征,TTBAD患者除夹层病变累及范围较小之外,升主动脉的直径也比非TTBAD患者的升主动脉直径小;与非TTBAD患者相比,TTBAD患者的真腔直径更大,且TTBAD患者破口起源于小弯侧的夹层比例明显更高^[24]。笔者认为这与TTBAD患者的发病机制、损伤较局限以及TTBAD患者平均年龄较低有关。

3 TTBAD的严重程度划分

TTBAD的严重程度划分非常重要,对于手术决策和预后判断具有关键作用。既往,美国创伤外科协会将TTBAD按照损伤的动脉类型与动脉周长进行分度,认为所有的降主动脉损伤均为IV度损伤,未对主动脉损伤进行详细划分^[25]。随着认识的加深,目前最广泛使用的TTBAD严重程度划分方法可分为4度,是基于2009年提出的分度方法,并在2011年的美国血管外科协会(Society for Vascular Surgery, SVS)与2022年的美国心脏协会(American Heart Association, AHA)主动脉疾病指南中被引用^[1,26-27]。根据影像检查结果,I度表现为内膜撕裂、内膜片或两者都有;II度表现为壁内血肿;III度表现为主动脉壁破裂伴假性动脉瘤;IV度表现为主动脉破裂并出血。对于I度损伤,建议药物保守治疗并严密影像学复查;对于III、IV度损伤,在无手术禁忌情况下,建议行主动脉手术干预;对于II度损伤,若合并高危影像学表现,建议手术干预,否则建议可药物保守治疗并严密影像学复查^[1]。高危影像学表现包括:后纵隔血肿>10mm,病变与正常主

动脉直径之比 >1.4 ,纵隔血肿产生压迫表现,主动脉真腔受压,大量的左侧血胸,升主动脉、主动脉弓或大弯侧受累,以及主动脉弓部血肿^[1]。但是笔者认为,上述分度方法对于TTBAD的夹层双腔改变描述是存在不足的,尽管有时真假双腔变化确实与假性动脉瘤无法完全区分。

美国华盛顿大学的Starnes等^[28]根据影像学上主动脉外轮廓是否有改变提出了另一种分度方法,并在2019年发表了该分度方法的应用结果^[29]。将TTBAD分为轻、中、重三度损伤,轻度损伤定义为无主动脉外轮廓异常,内膜破口和/或血栓形成 $<10\text{ mm}$,建议无需特殊治疗,适当的影像学复查;中度损伤为存在主动脉外轮廓异常或内膜破口 $>10\text{ mm}$,建议行限期手术治疗,优先稳定合并损伤与控制血压心率;重度损伤为造影剂活动性外渗,左锁骨下动脉血肿 $>15\text{ mm}$,建议急诊手术治疗。

两种分度方法对于指导临床决策与预后都有意义,2024年欧洲心胸外科协会(European Association for Cardio-Thoracic Surgery, EACTS)/胸外科医师协会(Society of Thoracic Surgeons, STS)发表的主动脉综合征诊治指南中,对于两种分度方法都进行了引用^[30]。同时,Lozano等^[31]对两种严重程度划分方法进行对比分析,发现两种方法具有较高的一致性,但存在约20%的AHA I度、II度损伤会被划分为中度或轻度损伤,对于这些划分不一致的患者,笔者提出应根据患者的实际情况,尤其是合并伤的严重情况,决定是否手术治疗。

4 TTBAD 预后的高危因素

TTBAD的预后受到多种高危因素的影响,Starnes等^[28]提出,主动脉弓血肿厚度 $>15\text{ mm}$ 提示患者预后较差。一项纳入633例患者的研究中,院内死亡率为7.3%,年龄60岁($OR:11.33$)、肌酐 1.2 ($OR:5.28$)、男性($OR:4.26$)、损伤严重程度评分30($OR:3.86$)和左锁骨下动脉受损($OR:2.25$)是患者死亡的高危因素^[32]。一项Meta分析结果也表明,休克($OR:1.91$)和灌注不良($OR:3.45$)是患者术后早期死亡的危险因素^[33]。Lin等^[34]回顾性分析17年的创伤数据发现严重高血压、低氧血症也提示患者预后不良。此外,损伤引发的继发征象如假性动脉瘤、纵隔血肿、血气胸、胸膜腔内血肿等是夹层破裂的危险因素^[35-36]。了解TTBAD的高危因素有助于全面认识患者病情,指导后续治疗方案的选择。

5 治疗

TTBAD患者通常伴有肋骨骨折、腹腔内脏损伤和颅脑损伤等情况,这些损伤都会影响治疗方案的决策,需要多学科综合治疗协作组综合评估。早期研究表明,创伤中心诊治死亡率显著低于非创伤中心(75% vs. 90%)^[37],建议转运至设置有创伤中心的医院进行诊治。维持血压、心率平稳是TTBAD治疗的基础^[38],对于血流动力学不平稳或休克患者,需立即行静脉输液、输血、寻找休克原因并积极治疗。对于表现为高血压或者病情平稳患者,建议予以药物控制血压心率,指南中虽然对于TTBAD患者并没有提出具体目标,但是多项回顾性研究建议控制目标为收缩压 $100\sim 120\text{ mmHg}$ ($1\text{ mmHg}=0.133\text{ kPa}$),并平均动脉压在 80 mmHg 左右,心率 $60\sim 80\text{ 次}/\text{min}$ ^[23,26,39-40]。常用药物与非创伤性主动脉夹层一致,包括 β 受体阻滞剂、钙离子通道拮抗剂等,在急性期建议使用静脉泵入药物,如艾司洛尔、地尔硫卓、硝酸甘油或硝普钠等^[17,40],因其具有起效快且半衰期短的优势,相比长效口服药更适用于可能出现低血压的TTBAD患者。血压的平稳控制是改善TTBAD患者预后的基础,对于I度TTBAD患者可通过药物保守治疗完全康复,研究表明,对于部分II度损伤患者单纯药物保守治疗亦能取得良好疗效^[41-42]。

TTBAD的手术治疗主要包括开放手术与腔内手术(thoracic endovascular aortic repair, TEVAR)。随着腔内器械的发展和技术的成熟,对于解剖学无禁忌患者,TEVAR目前已取代开放手术成为TTBAD患者首选的治疗方式^[38,43-47],并在多项最新主动脉疾病管理指南中获得推荐^[1,18,26,30]。在TTBAD患者中,尚无对比开放手术与TEVAR的多中心临床RCT研究,但多项较高级别的证据都证明了TEVAR在TTBAD中的优势。Xenos等^[48]Meta分析收集2003—2007年发表的文献数据,在TTBAD患者中,369例开放手术患者与220例腔内手术患者相比较,腔内手术组手术相关死亡率、30d总死亡率与截瘫发生率显著低于开放手术组。2020年,Harky等^[49]搜集PubMed、Embase、Scopus和Ovid 4个数据库,对21篇文章中的1968例TTBAD患者进行了分析,相较于传统的开放手术,TEVAR 30d死亡率及1年死亡率较低。同时,基于美国国家创伤数据库的多中心研究也发现,对于TTBAD患者,与开放手术相比,TEVAR的重症监护室和住

院时间减少,急性肾损伤和急性呼吸窘迫综合征的发生率也明显降低^[50]。总的来说,TEVAR具有手术时间短、成功率高、创伤小、术后并发症少、恢复快等优点。同时,由于TTBAD患者合并其他器官损伤可能会增加术者对手术中使用肝素的担忧,因此在围手术期应根据每例患者的总体出血风险平衡是否使用肝素。在TEVAR围手术期过程中使用全量肝素、低剂量肝素和不使用肝素在出血、血栓栓塞或死亡率方面没有差异,但使用全量肝素的TTBAD患者接受TEVAR的时间比不使用肝素的TTBAD患者多3倍^[51]。

除了手术方式之外,手术时机的选择对于TTBAD患者也十分重要,但目前存在一定争议。以前的观点认为患者一旦确诊TTBAD,则应尽早行手术治疗^[52]。2011年SVS创伤性胸主动脉损伤临床实践指南建议,在24h内TEVAR手术治疗或者在处理完其他更严重的创伤后尽早行TEVAR治疗^[26]。在2015年美国东部创伤外科协会指南中,推荐延迟TEVAR治疗,尤其是对于合并其他重症损伤的TTBAD患者^[18]。在2022年发布的美国AHA主动脉疾病管理指南中,随着临床数据的增多,对于手术最佳时机未给出明确推荐^[1]。Marcaccio等^[53]Meta分析统计507例患者数据发现,早期TEVAR(入院24h之内)的死亡率为11.9%,而延迟TEVAR(入院24h之后)的死亡率为5.4%,差异具有统计学意义($P=0.047$),但早期TEVAR有较短的ICU及住院时间、使用呼吸机的天数。Romijn等^[54]对1339例患者的统计分析也有相似结果,早期TEVAR与延迟TEVAR相比,具有较高的死亡率(8.8% vs. 4.4%, $P=0.028$),但急性肾损伤风险较低(3.3% vs. 7.7%, $P=0.029$)。一项多中心研究结果也发现,早期TEVAR具有较高的死亡率($P=0.008$),但在进一步的亚组分析中并无统计学差异^[31]。TTBAD患者的最佳TEVAR干预时机的确定仍需要更多临床数据的支持,部分研究者亦认为早期TEVAR的高死亡率可能与行早期TEVAR患者的病情更严重有关。对于手术时机的选择,笔者认为应根据患者的实际病情,在临床实际中要根据哪处损伤更危及生命来决定。若TTBAD为主要损伤,对于因主动脉损伤导致生命体征不平稳的Ⅲ、Ⅳ度患者,则优先治疗TTBAD并行急诊TEVAR;若患者存在其他合并致命伤,则优先处理致命伤,待患者病情稳定后再行延迟TEVAR,或者对于平稳的Ⅱ度损伤,建议严格药物控制血压和复查CTA的情况下行延迟TEVAR。对于血流动力学平稳的Ⅲ度损伤

患者,本中心经验(数据尚未发表)发现延迟TEVAR亦具有良好疗效。当然,上述策略在文献中也得到了支持^[36,55-56]。

6 预后与随访

对于能够术后顺利出院的TTBAD患者,整体预后较好。研究表明,TEVAR术中存在3%的支架移位与2%的内漏发生率^[57],但平均52~60个月的中期随访数据表明,TEVAR术后支架移位、内漏与再干预概率均较低^[58-61],但TTBAD患者开放与TEVAR术后的长期随访数据均非常有限。对于保守治疗出院的TTBAD患者,7.6%患者病变进展,34%患者病变改善或愈合(最长118个月的随访);对于Ⅰ、Ⅱ度TTBAD患者,只有0.68%病变进展或/和再干预率^[62]。对于TTBAD患者的随访,SVS临床实践指南建议,TEVAR术后随访影像学检查无异常(即支架移位、内漏)时,可减少至每2~5年随访1次^[26]。

7 总结

本文深入探讨了TTBAD的发病机制、临床特点与诊断、严重程度划分与高危因素以及治疗策略。TTBAD常发生于急性减速性创伤中,多发生在主动脉峡部,损伤机制可能涉及多种力的同时作用。TTBAD常合并其他器官损伤,诊断挑战大,易漏诊,增强CT或CTA是首选的影像学检查。TTBAD严重程度划分是决定治疗策略和预后的关键因素。TTBAD的治疗需考虑多学科协作,在药物治疗基础上,TEVAR成为主要手术治疗方法,但手术时机选择仍存在争议,对于合适患者,延迟TEVAR可能有助于降低TTBAD患者的死亡率。顺利出院的TTBAD患者整体预后较好。但创伤性主动脉夹层的临床诊治仍非常具有挑战性,需要更多的临床数据、长期随访结果与高级别证据的发表。

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